

# PARTICLEBOARD & MEDIUM DENSITY FIBRE BOARD

## History of Particleboard

“Particleboard manufacture was developed in Germany in the late 1940s and introduced to Australia in 1957 when Coreboard Ltd. (later purchased by Softwood Holdings Ltd.) established a plant at Mt. Gambier, S.A.. It used radiata pine thinnings and saw-log tops, for which there was little alternative use. After bark removal the logs were converted into thin flakes which were dried, mixed with urea-formaldehyde resin and then continuously extruded through a heated die. A second plant, built at Oberon, NSW by Pyneboard Pty. Ltd. (a subsidiary of CSR) in 1960, used an improved process which formed the board on an endless steel wire mesh, cut it into lengths and then pressed it between heated platens.

The expanding economy of the 1960s, the increasing availability of suitable raw material and the high acceptability of the product led to more new plants and a very high annual growth rate, some of it at the expense of hardboard and plywood. In the 1970s this tapered off as building industry activity slackened but new plants continued to be built, so that by 1978 capacity utilization was down to about 60 per cent.

The industry has been innovative in raw material, process and product, principally by adapting overseas developments to local conditions. It has made extensive use of sawmill residues, which now amount to over 50 per cent of its raw material. While multi-daylight pressing is normal practice, single-daylight pressing, with the sheet carried on an endless belt, was introduced by Softwood Holdings at a new plant in Mt. Gambier in 1981 to make sheets up to 20 m long.

Wood-veneered particleboard was first introduced in 1961, by Westralian Forest Industries. WESFI. In the early 1970s particleboard surfaced with plastic laminates was introduced and in the mid-1970s, after much joint development with resin suppliers and CSIRO Division of Building Research, a flooring grade was developed using water-resistant phenol- or tannin-formaldehyde resin. This led to other potential structural applications which were explored by the industry with help from the Wood Technology Division of the NSW Forestry Commission and the Capricornia Institute of Advanced Education.

Oriented strand board (OSB), a particleboard variant in which somewhat elongated particles are used and oriented to increase longitudinal strength, has very recently been introduced by Pyneboard at their Tumut, NSW plant. The process has been in use overseas for some years where it competes with structural plywood.

The particleboard industry has become an important factor in the overall economics of softwood plantation forestry because of its use of thinnings, tops and sawmill residues. It has also reduced the demand for solid wood and plywood.”

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## FINISHING

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### Scope

This Data Sheet describes the basic principles of finishing Particleboard and Medium Density Fibreboard (MDF), including semi-finished and fully finished boards from Australian Wood Panels Association members.

Particleboard and MDF provide an ideal base for a wide variety of surface treatments. Apart from clear finishes and paints these include wood veneers, high and low pressure laminates, papers, PVC film and fabrics. The following notes give guidance on the suitability and application of these treatments, but are not intended to provide complete application instructions. Consult finish manufacturers instructions for complete details.

### Clear Finishes

The surface colour and pattern of Particleboard and MDF is naturally decorative and the application of a clear finish accentuates this quality and provides a wear-resistant coating. For floors, a two-part polyurethane finish will provide an excellent hard-wearing and decorative surface. The floor must first be fine sanded and then vacuumed to remove all dust. Nail holes should be filled with appropriate coloured putty. Apply the polyurethane finish with a wide brush or lambs wool applicator.

When Particleboard flooring is used in platform construction, the use of a sealer prior to closing in the building is not recommended. Some moisture will still penetrate the surface and the effect of hot sun under these conditions will cause more deterioration than with an unprotected board. When the house is closed in, the Particleboard should be sanded (after drying out) and the clear finish then applied.

For other Particleboard and MDF surfaces (such as wall linings, partitions or ceiling surfaces) a one-part polyurethane coating will provide a good wearing clear finish. The surface may be filled before finish application which can be high gloss, satin or matt. An attractive surface can also be produced with clear Pine Finish or with pigmented or dye-type stains. Cellulose lacquer will also provide a satisfactory finish. However its wearing properties are inferior to polyurethane's and it would only be used if cost savings could be achieved. Manufacturers' instructions should be followed for specific applications.

### Paint

Although the surface of Particleboard and MDF appears to be smooth, it invariably contains small holes and interstices which become noticeable when paint is applied. There are three basic paint systems which can be used to give a range of surface finish quality.

In order to obtain the best quality, full gloss finish, the use of a filler is necessary. The surface should first be primed and then a fine surface filler applied. The filler will most likely be trowel-applied rather than brushed on. Rub down to give the required surface and then continue according to paint manufacturers' instructions.

A first-class finish can readily be obtained with oil-based paints, polyester and melamine lacquers. Polyester and melamine lacquers are usually applied in industrial operations and require baking to cure and harden the coating.

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The oil-based paint system consists of primer, undercoat and then enamel which will provide a good measure of surface filling from the paint films deposited. Oil-based paints also give better performance than water-based paints when steam or grease may be present (bathrooms and kitchens).

Emulsion and other water-based paints tend to swell surface particles of the wood panels which can result in a textured finish. The prominence of this texture will depend on the water content of the paint used and the reaction of the board surface to the moisture in the paint. With acrylic paint systems, an exterior-grade primer should be applied first, followed by undercoat and two coats of acrylic gloss or semi gloss. Sanding before final coats, and the use of a semi gloss finish will minimise the texturing mentioned above and produce a quite satisfactory result for most applications.

## **Vinyl Film**

These can be woodgrain prints with matching embossing, or plain colours, with a smooth or textured surface.

Higher quality woodgrain pattern are usually surface printed with a clear protective PVA overlay or highly scratch resistant lacquer finish.

PVC film can be applied on a small scale using, for instance, cold setting ethyl vinyl acetate (EVA) emulsion adhesives in simple nip roll presses. However for high quality, high volume production, continuous laminating lines are required. EVA emulsions, two-part solvent-based polyurethane or epoxy systems are used. The adhesive is applied as a thin film to either the board surface or reverse side of the vinyl and where applicable, the excess solvent is flashed off and the vinyl nip-rolled onto the board. Vinyl coated board is available from wood panel manufacturers as well as independent processors laminating for the industry. The product is generally used for furniture manufacture, e.g. wall units, TV and Hi Fi cabinet speaker boxes and computer desks. The flexible nature of the PVC film has resulted in the development of the V grooving technique where the substrate is machined away leaving a 90° groove connected only by the PVC. This can then be folded to a right angle or to more complex profiles - many grooves of varying sizes are machined and multiple folding produces a shaped edge e.g. the front edge of a TV cabinet.

As with other laminated wood panel products, it is recommended that for large, freestanding panels, a balancing film is applied to the reverse side.

Matching edge banding can be obtained from vinyl manufacturers for edge finishing. High volume production is usually carried out on a proprietary edge banding machine using hot melt adhesive. Small operations can be carried out by hand using contact adhesive.

PVC film is not generally recommended for horizontal work surfaces.

## **Veneer**

Natural wood veneer is generally regarded as the premium decorative finish for wood panels because of the individuality offered in choice of grain definition and species. Veneers are readily applied to Particleboard and MDF provided the substrate is of good quality, the board is uniform in thickness and the surface is dense and smooth with well bonded surface flakes. Urea formaldehyde and crosslinking P.V.A. resins are normally used.

In order to obtain stability of the product a balancing veneer must always be applied to the reverse side. Veneered Particleboard and MDF is available in good-one-side or good-two-sides configuration in both sliced and rotary cut veneers, and is usually supplied fine sanded by the manufacturer. Veneers can be finished with clear lacquer, oil, stain or paint depending on the wood species and the end product requirement. Exposed edges of veneered Particleboard panels are generally protected by matching solid timber edging, matching

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veneer applied by an edge bander using hot melt adhesive or by the use of pre-glued, "iron on" veneer. Veneered MDF panels may have similar edge treatment but MDF edges can also be moulded and machined due to the better edge machining properties of MDF.

## **High Pressure Laminates**

A hard wearing, scratch-resistant and easily cleanable surface is obtained by the application of a plastic laminate to Particleboard and MDF. Widespread use is made of this composite material in the furniture industry and particularly for kitchen units and bench tops.

Laminates can be applied by the furniture manufacturer using sprayable contact adhesive and a nip roll press. However they are often applied by carpenters during cabinetwork or shopfitting. In this case, adhesive is applied by brush or spreader, and bonding is achieved by hand roller or hand-applied pressure over the laminate surface.

Laminates are constructed from several layers of phenolic resin impregnated paper, together with 1 to 3 sheets of overlay papers, printed or clear, and impregnated with melamine resin. The finish can be gloss, matt or textured.

When any decorative overlay is applied to wood panels, it is generally recommended that a compensating overlay be applied to the opposite surface to balance the panel and ensure stability. High Pressure Laminates are often used successfully as a one side only overlay. The rigidity of the laminate itself aids stability, as does the stiffness of supporting framework such as for table or bench tops.

## **Low Pressure Melamine**

Resin impregnated papers are applied to wood panel sheets in a short cycle hot press. Heat and pressure cause melamine resin to flow into the board surface and cures to a hard plastic finish that is an integral part of the surface, not just adhered to it.

This product is manufactured by most wood panel producers as well as several independent processors. Melamine-surfaced board is the most wear resistant of Particleboard and MDF finishes and is the largest and fastest growing segment of the range of finished wood panel products.

The full process consists of the following steps:

- \* Coloured or printed papers are impregnated with complex thermosetting resin formulations in a single or double dipping operation. Melamine is either the only resin used or it forms the outer layer of the impregnation to ensure a product of excellent properties results.
  - \* The paper with its predetermined loading of resin is dried as a continuous sheet as it is transported through the hot air oven section of the "treater" plant.
  - \* The paper, dried to the desired moisture content, contains partially polymerised resins. The sheet is docked to the desired lengths and stored in packs awaiting laminating to board substrate.
  - \* Impregnating papers are always laid to form a balanced two-side construction on the panel core. At high heat and pressure in the laminating process, the melamine flows rapidly, integrally bonding with the board surface. An excellent surface pattern is formed, according to the texture of metal caul plates fitted to the press platens.
- A range of surface finishes and textures can be produced by selection of appropriate coating resins and press plates. The range includes gloss, satin, velvet, stipple and woodgrain embossed.
- Economy and quality control require that these operations are carried out on large scale, automated equipment.

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Low Pressure Melamine products have wide application in cabinet making, cupboards, built-in wardrobes and vanity units and more recently into all areas of furniture manufacture.

While the products are ideal for shelving, they are not recommended for horizontal work surfaces unless a special wear-resistant grade of laminate is used.

Sheets can be pre-edged with matching melamine finish by the manufacturer or the user can apply edging.

## Papers & Foils

Papers and foils of varying thicknesses or weights eg from 30 gsm to 100gsm, can be applied to wood panels using techniques similar to those used in the application of PVC film. There is a considerable range in the types and patterns available, from plain paper, which can often be used as a base for further finishing, to decorative patterned or woodgrain finishes. The latter are available chemically etched or embossed to highlight the grain. Papers are also available with a clear protective coating e.g. polyurethane.

## Fabrics

For special effects, fabrics of various types may be bonded to Particleboard and MDF. PVA or cold setting UF formulations are satisfactory .

## Health & Safety Information

Normal health and safety precautions should be taken when working with wood panel products. Machine tools should be fitted with dust extraction and work areas should be kept clean. If dust levels exceed The National Occupational Health & Safety Commission's standards, the wearing of a dust mask (AS/NZS 1715 and AS/NZS 1716) and safety glasses is recommended.

Storage and work areas should be adequately ventilated. If large quantities of Particleboard or MDF are stored in non-ventilated areas, formaldehyde emissions could accumulate to levels that may irritate some people.

For further information, please contact one of the manufacturers listed below for a Material Safety Data Sheet or download from [www.woodpanels.org.au](http://www.woodpanels.org.au)

Carter Holt Harvey	Tel 1300 658 828	<a href="http://www.chhwoodlogic.com.au">www.chhwoodlogic.com.au</a>
The Laminex Group	Tel 03 9848 4811	<a href="http://www.thelaminexgroup.com.au">www.thelaminexgroup.com.au</a>
D&R Henderson Pty Ltd	Tel 02 4577 4033	<a href="http://www.drhenderson.com.au">www.drhenderson.com.au</a>
Alpine MDF Industries Pty Ltd	Tel 03 5721 3522	
Tasmanian Wood Panels (Aust)	Tel 03 9460 7266	